Connecting Rod

an I-DEAS Exercise in Solid Modeling

by

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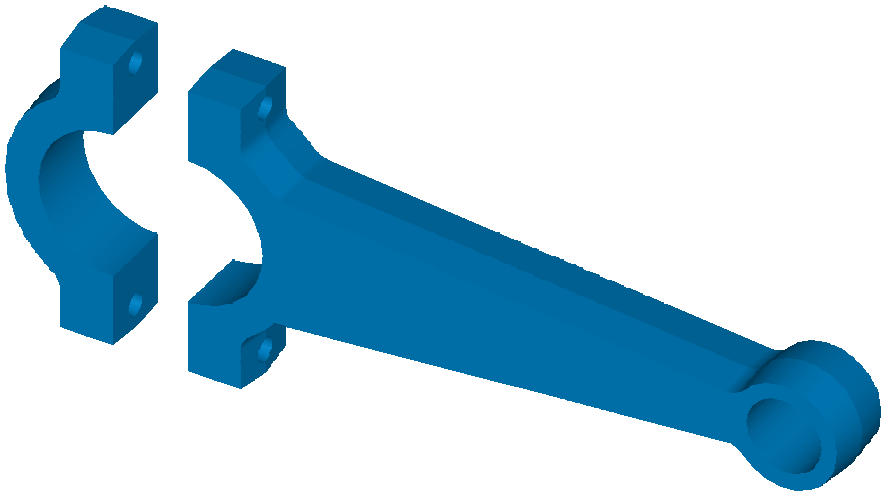


Build a Connecting Rod

In this exercise you will build a model of a connecting rod for a piston engine. Here are some tips to remember when going through the exercise:

- Pay attention to the I-DEAS List and Prompt regions at the bottom of the large display window. The prompt region asks you for feedback or to select entities, the List region provides information.
- You can elect the default response from the prompt region by clicking the center mouse button. The button assignments are:
  - Left button - pick or select
  - Center button - Done or OK or accept default
  - Right button - display list of options for current command
- Save your work after the completion of every successful step. If you make a mistake on the next operation, you can recover to the model state from the last *Save* by typing *Ctrl-z*. There is no general Undo feature in I-DEAS!
- Use the Dynamic Viewing buttons (F1-Pan, F2-Zoom, and F3-3D Rotate) to adjust the display while you are in the middle of a command to help you select the entity you want. Hold the appropriate button down and drag the mouse in the display region.

Build a Connecting Rod

1. Start I-DEAS in Master Modeler and open a new model file, call it Engine
2. Under **Options… Units**, set the units to *inch-pounds*
3. Under **Options… Modeler/Assembly**, turn off *3D VGX Extrude*
4. On the Workplane, sketch a horizontal line, *approximately* 4 in. long.
5. Sketch a circle, centered on the left end of the line, *approximately* 1.5 in. in diameter.
6. Sketch another circle, *approximately* 0.75 in. dia., centered on the other end of the line as shown in Fig. 1.

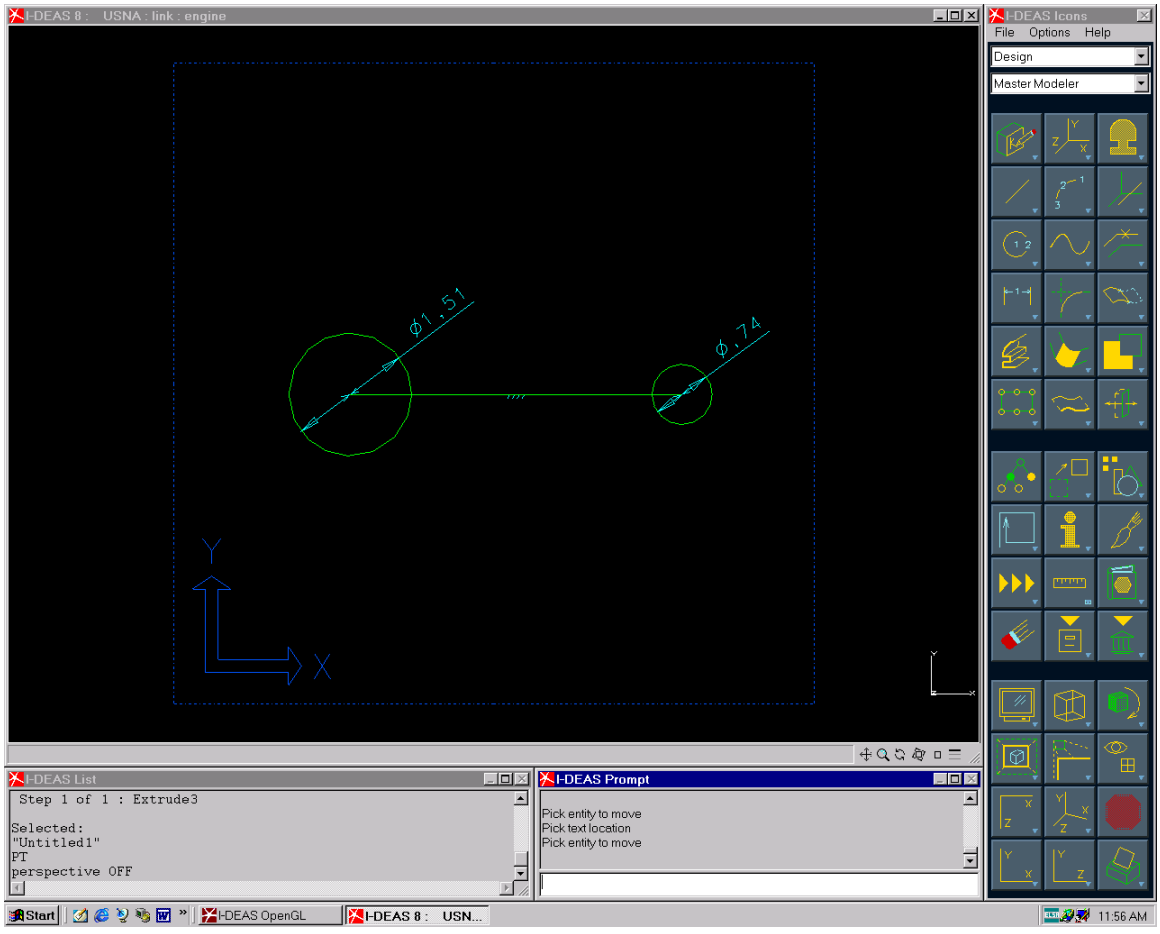


Figure 1

7. Using the Rectangle by Center method, sketch a rectangle *approx*. 2 in. high x 0.75 in. wide, centered on the left end of the horizontal line, as shown in Fig. 2.

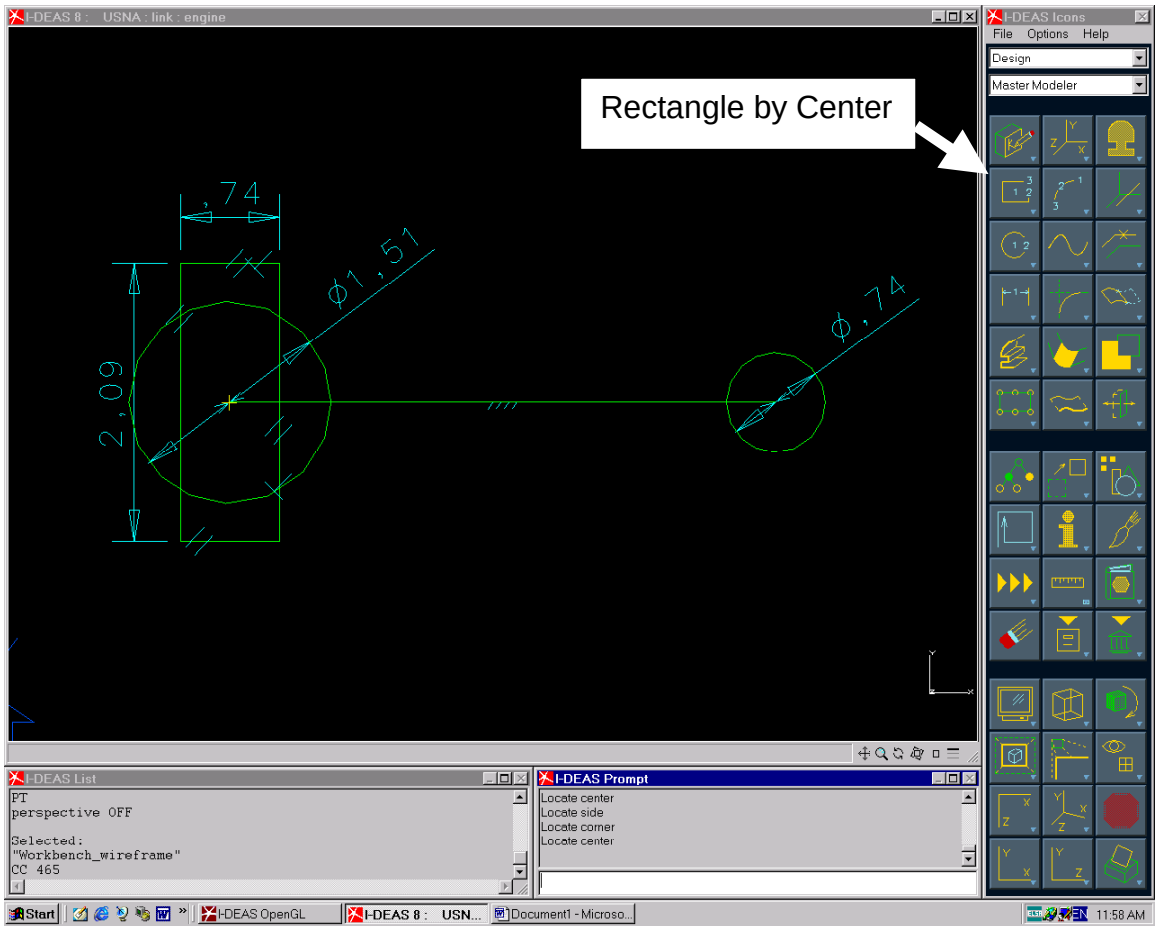


Figure 2

8. Sketch an inclined line from one circle to the next as shown in Fig. 3. Before selecting the starting point, use the right mouse button (hereafter called RMB) to display the Options and select Navigator… and turn off the tangency constraint and recognition, Fig. 4.

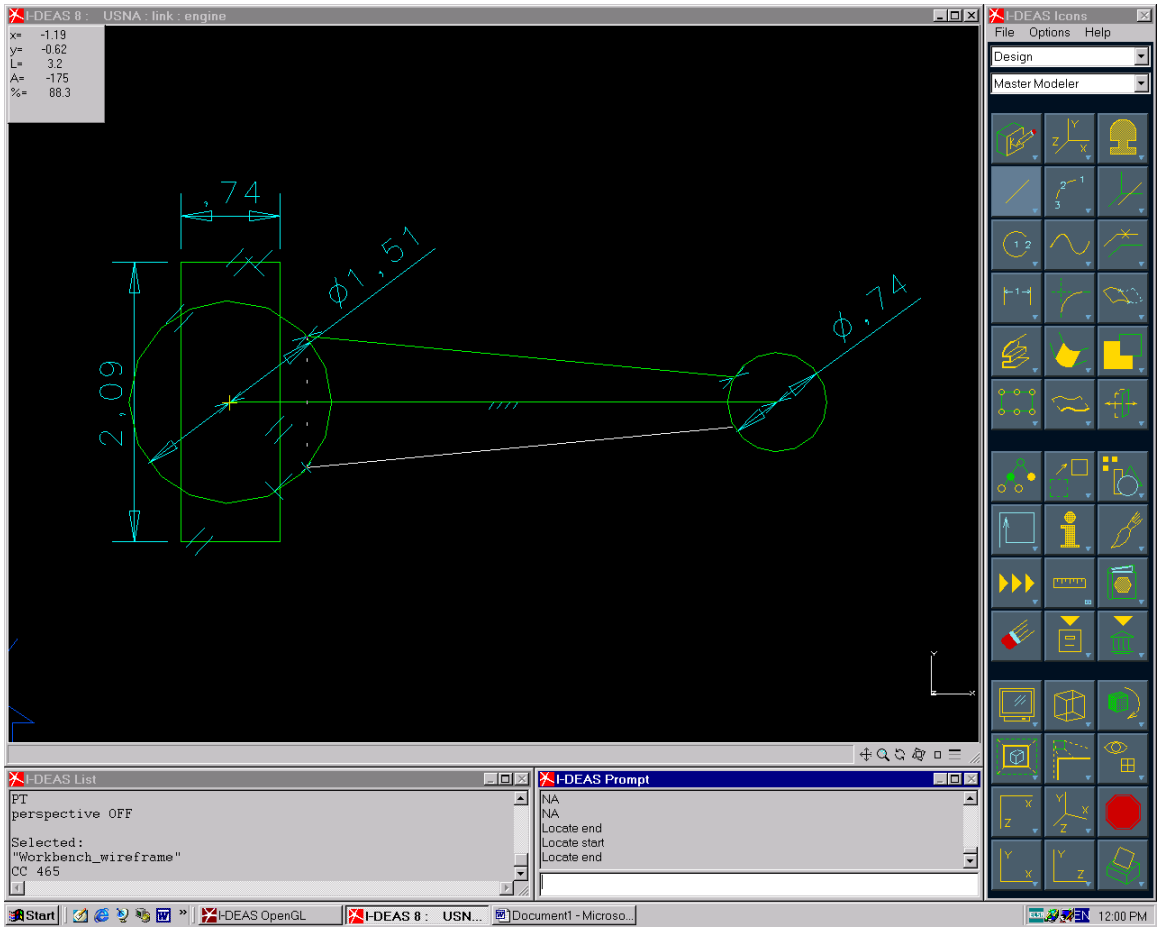
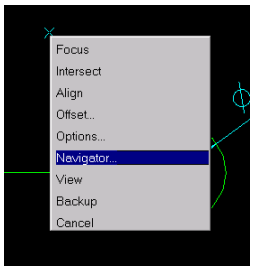


Figure 3


Focus
Intersect
Align
Offset...
Options...
Navigator...
View
Backup
Cancel

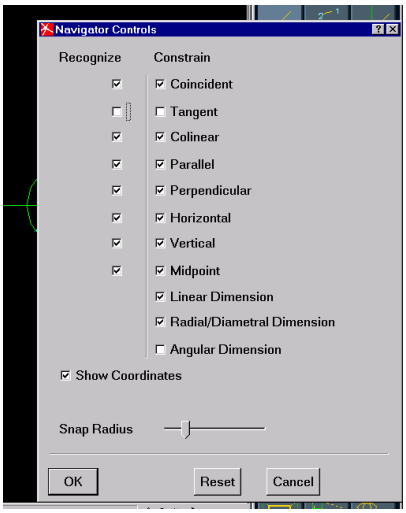

Navigator Controls
Recognize
Constrain
Coincident
Tangent
Colinear
Parallel
Perpendicular
Horizontal
Vertical
Midpoint
Linear Dimension
Radial/Diametral Dimension
Angular Dimension
Show Coordinates
Snap Radius
OK
Reset
Cancel

Figure 4

9. Change the appearance of the dimensions to reflect American standards. Pick the Appearance icon (the Paintbrush), select any dimension, click the RMB and choose **All**, then **MMB** (Done). Under Dim/GDI Standard, select **ASME 1994**, under Units/Decimals, select xx.xxx to show three decimal places. Pick OK and on the main pop-up, check the **Autoscale** box and then click **Set as Default**

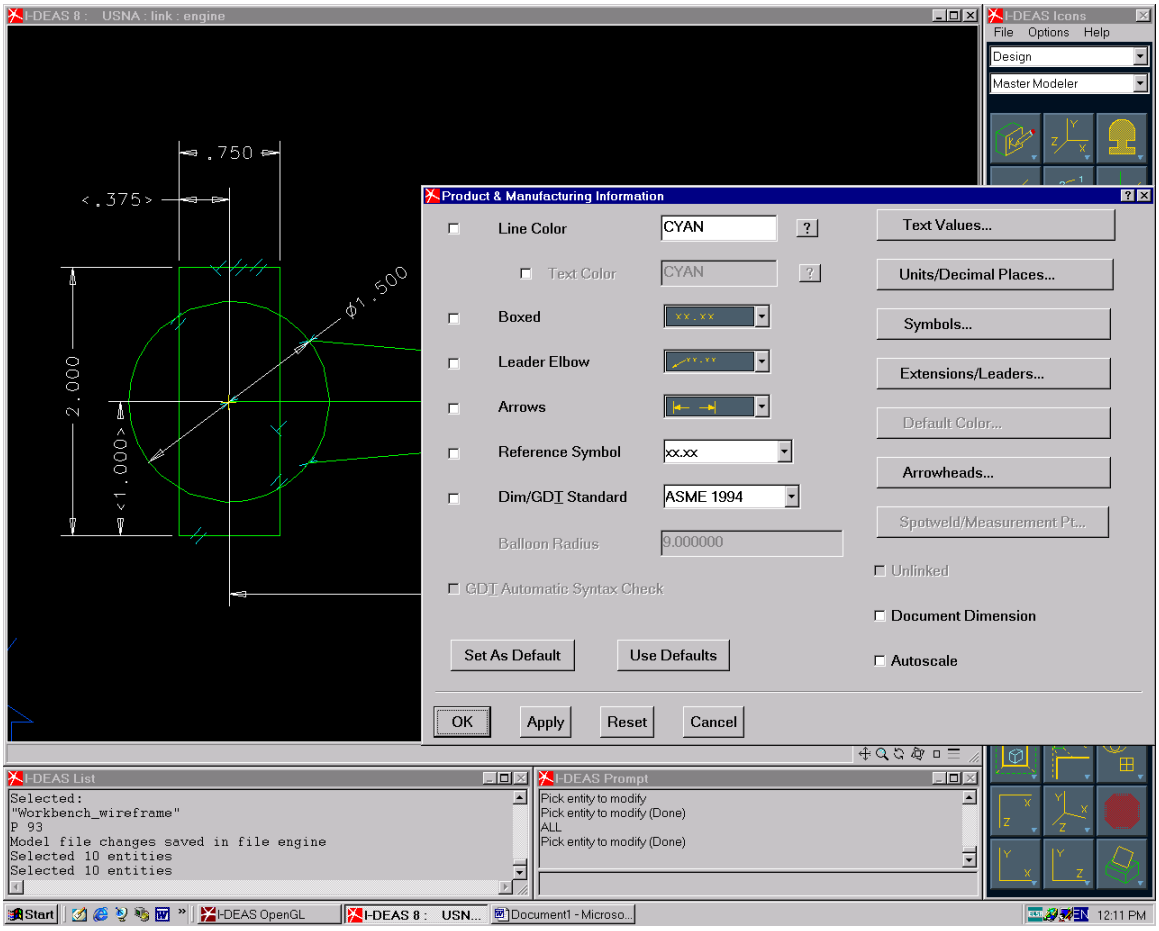


Figure 5

10. Use the **Dimension** icon and add dimensions as shown in the figure below. When the wireframe is fully constrained, it will appear blue.

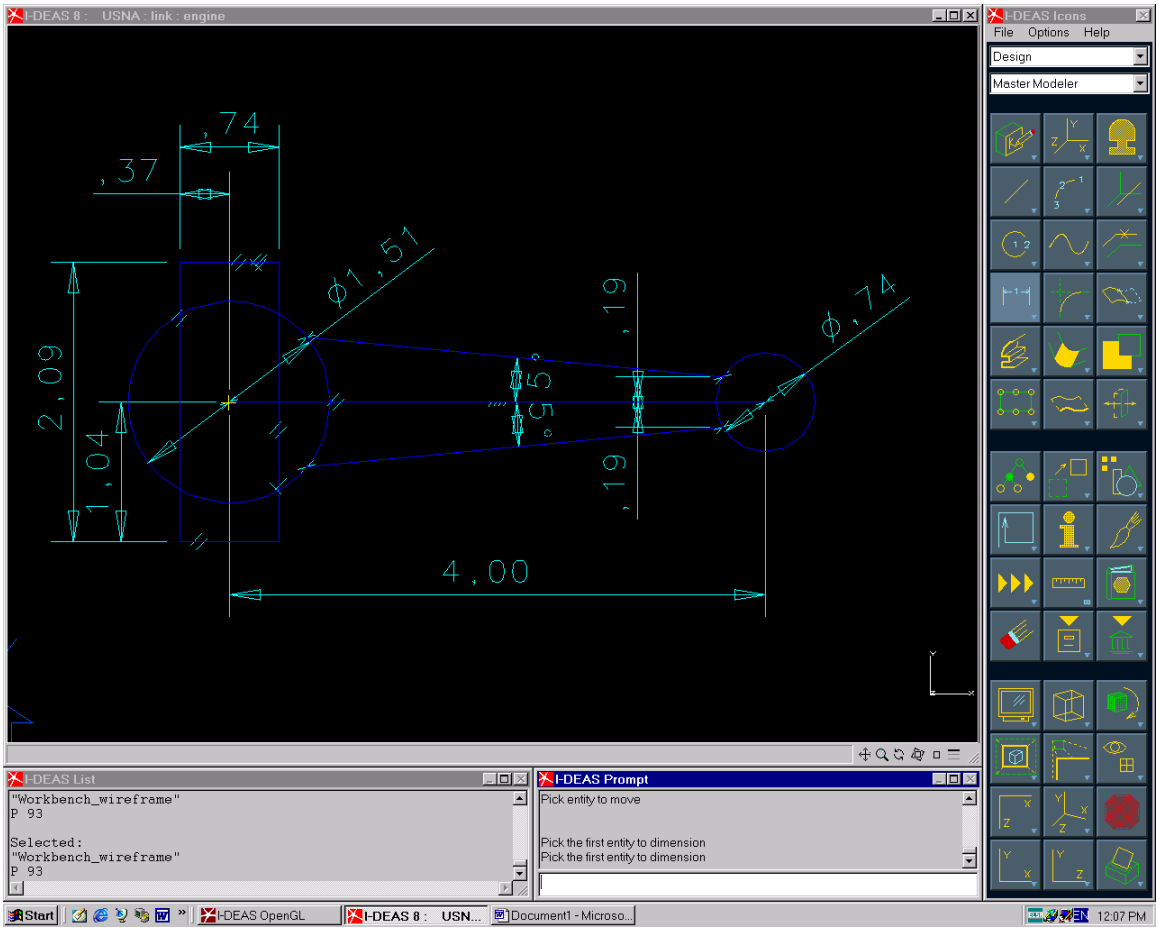


Figure 6

11. Modify the dimensions so that they have the values shown below.

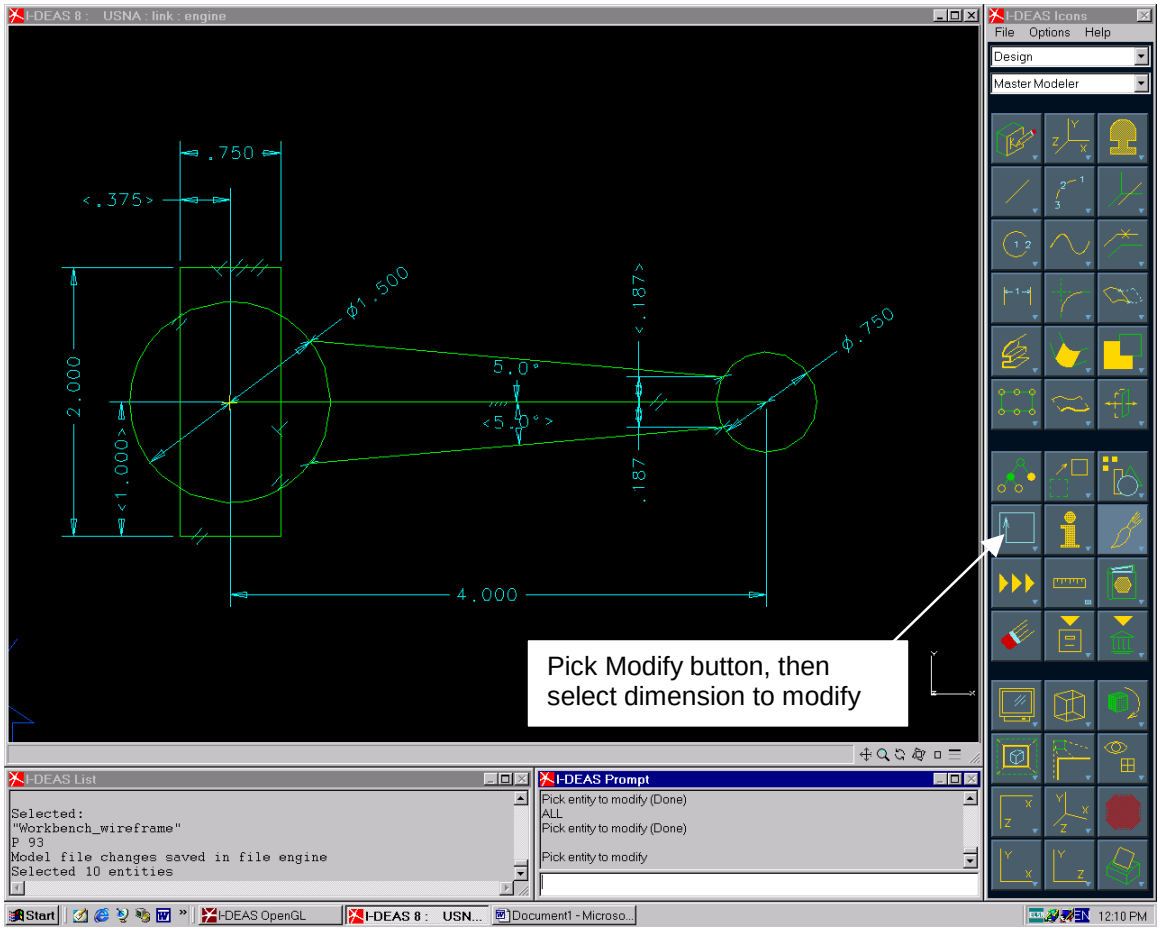
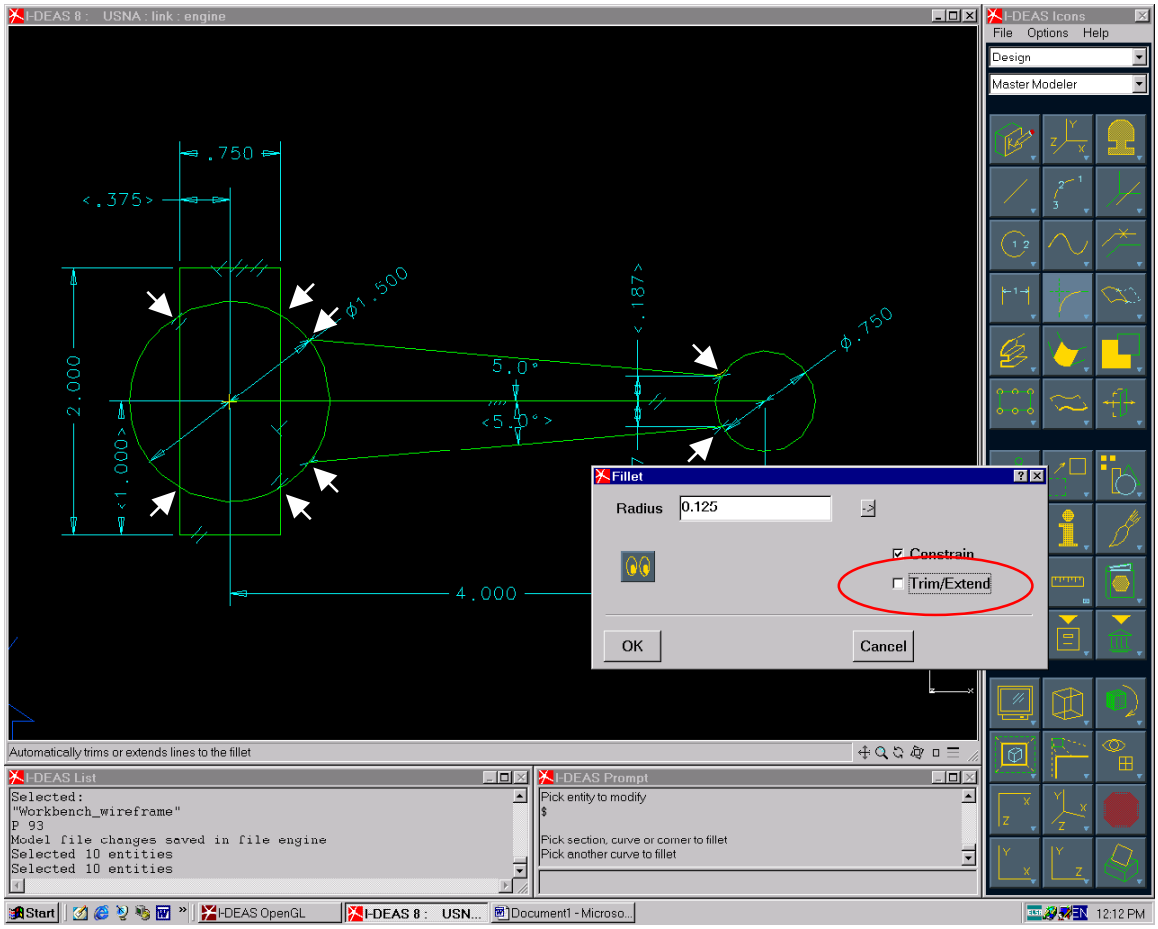
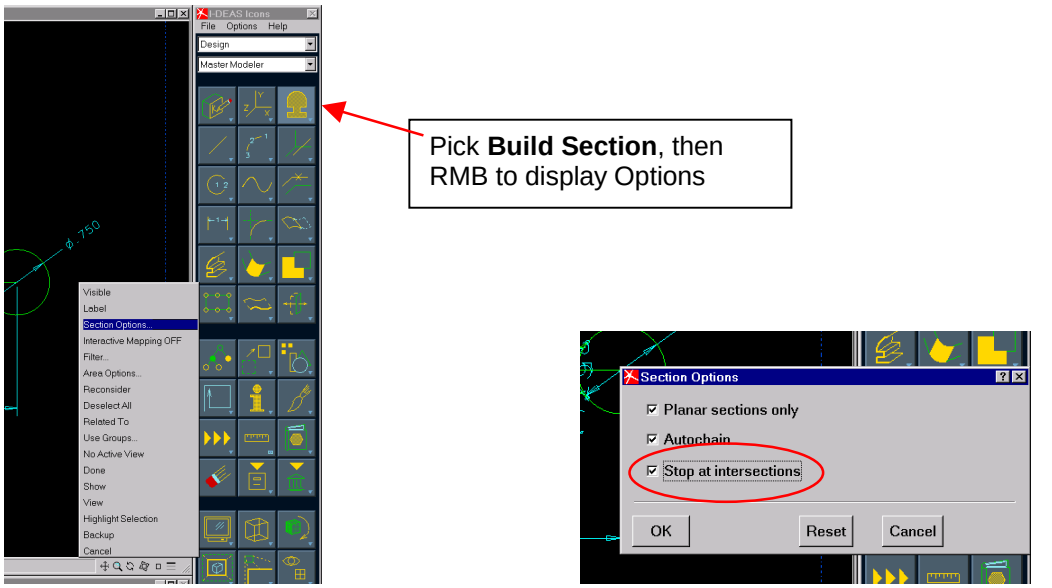


Figure 7

12. Add 0.125 in. radius fillets to each of the corners shown below. Turn off the Trim/Extend option first.



13. Build a section of the outline of the connecting rod. Select the **Build Section** icon, RMB, **Section Options…** Check **Stop at Intersections**. Build the section by clicking on each segment of the outline as you move around the perimeter.



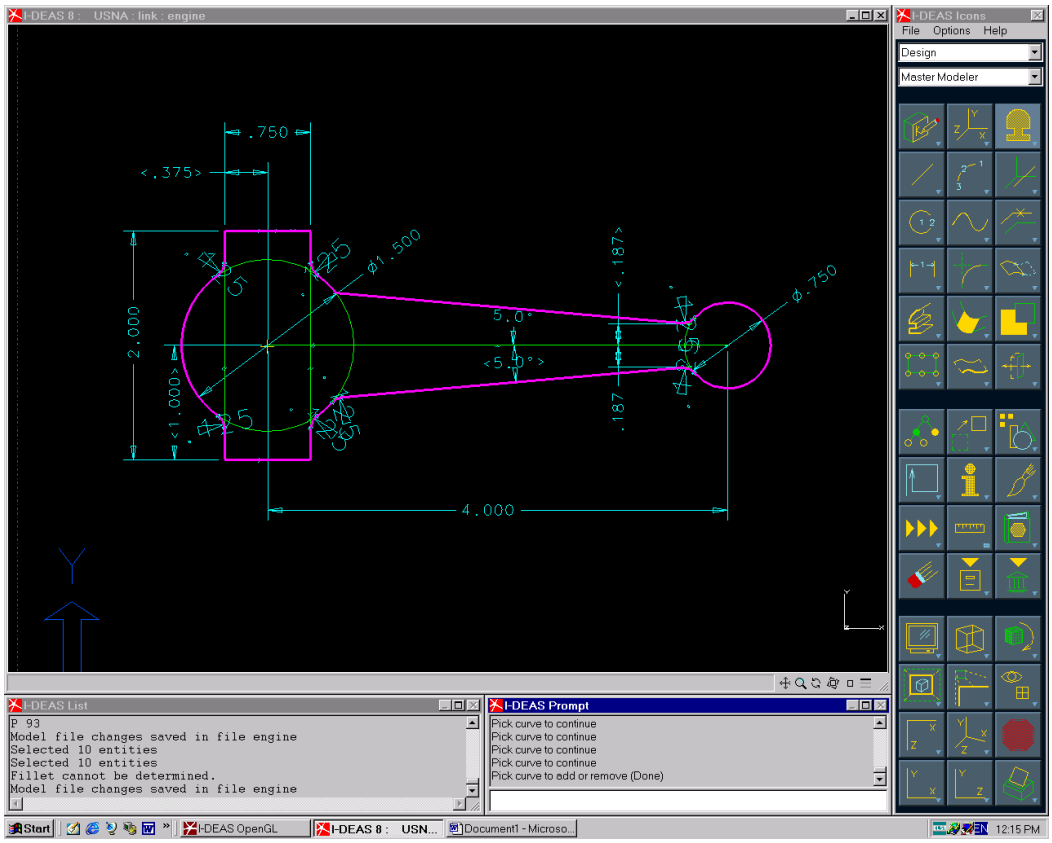


Figure 8

14. Extrude the section to form a solid object. Pick the **Extrude** icon, choose the section you just defined. On the Extrude Options form, set the distance to 0.5, select Thicken, check the Draft Angle option and enter –5 for the parameter, then click OK

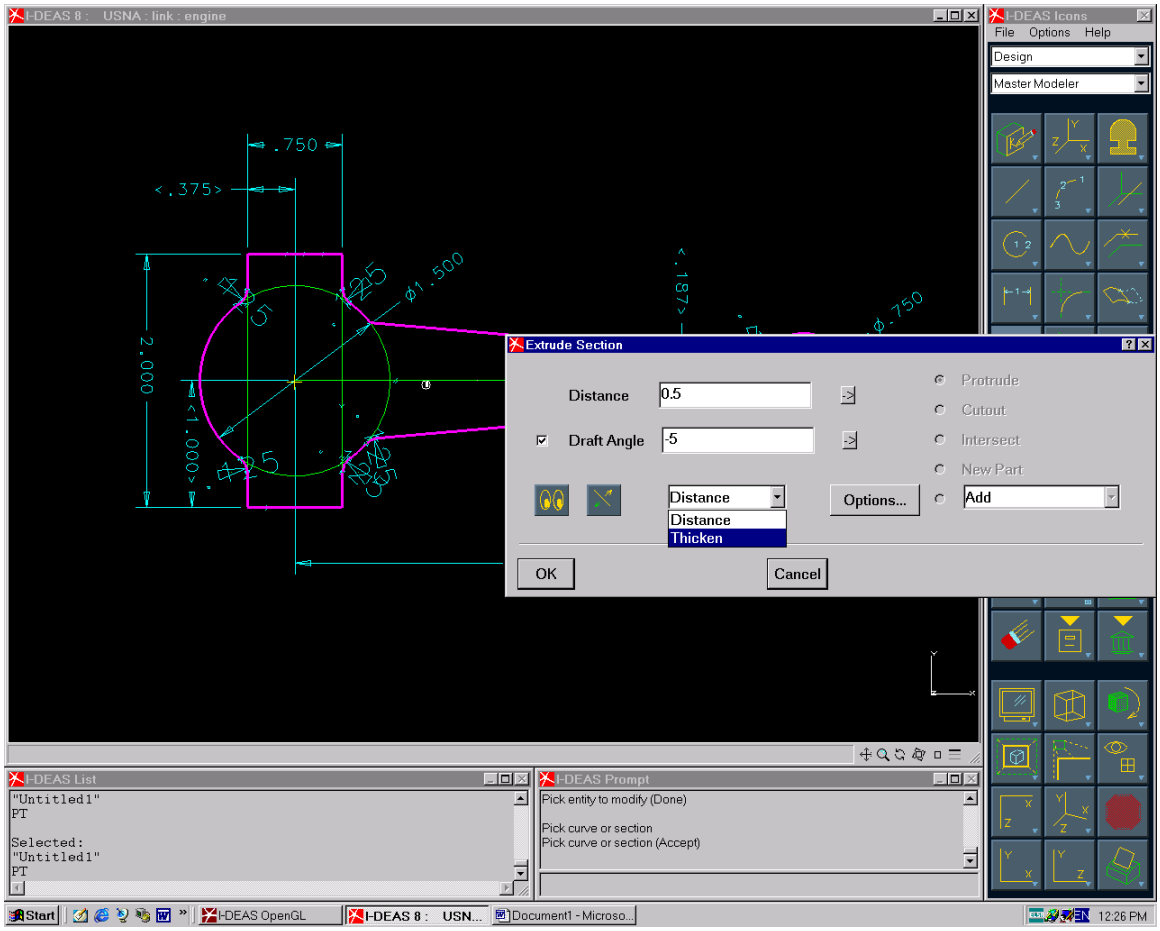


Figure 9

15. If all went well, you should have a solid object like that shown below. Use the Dynamic Viewing buttons to adjust the display (Position the mouse in the display area, hold F3 and drag the mouse)

Save your good work to this point!

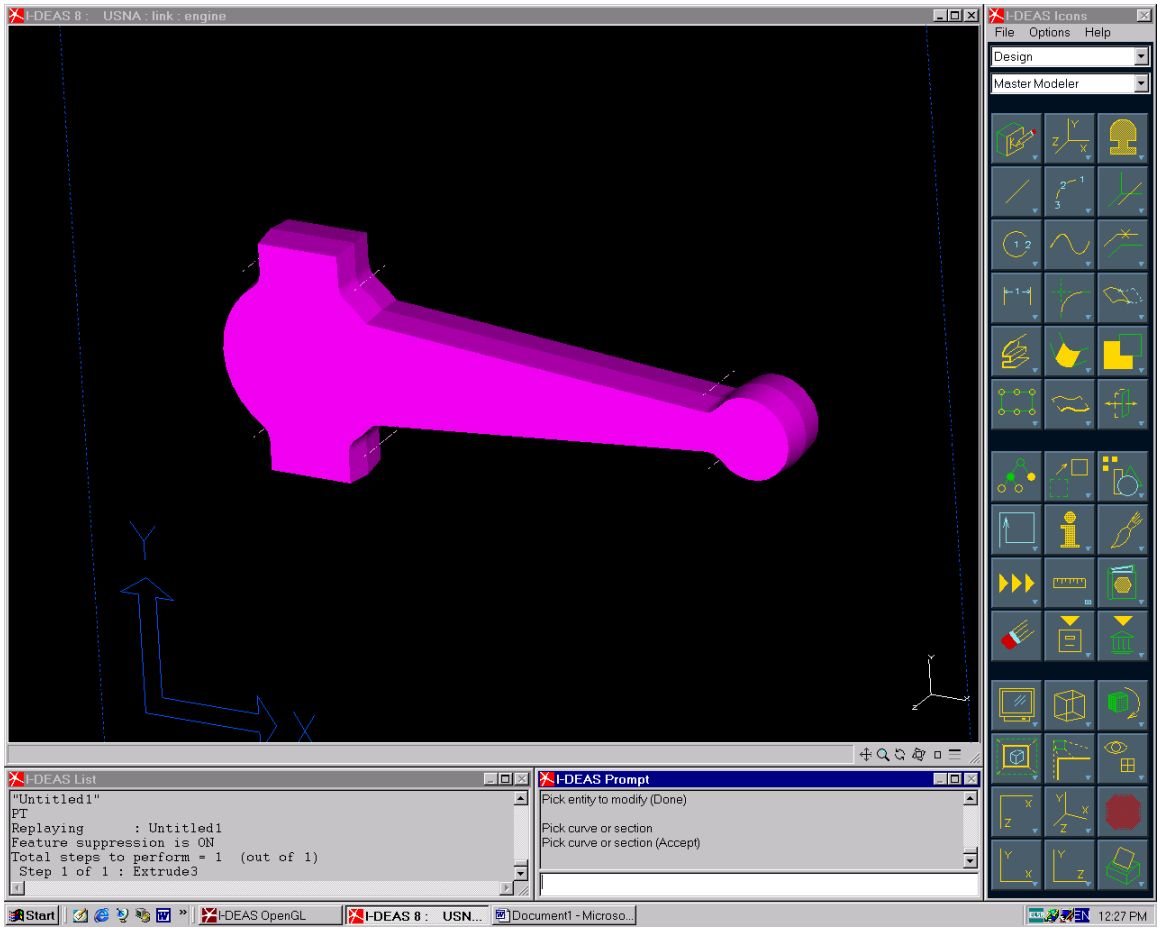


Figure 10

16. Pick **Sketch in Place** and select the front surface of the connecting rod. A dark blue outline should appear on this plane.

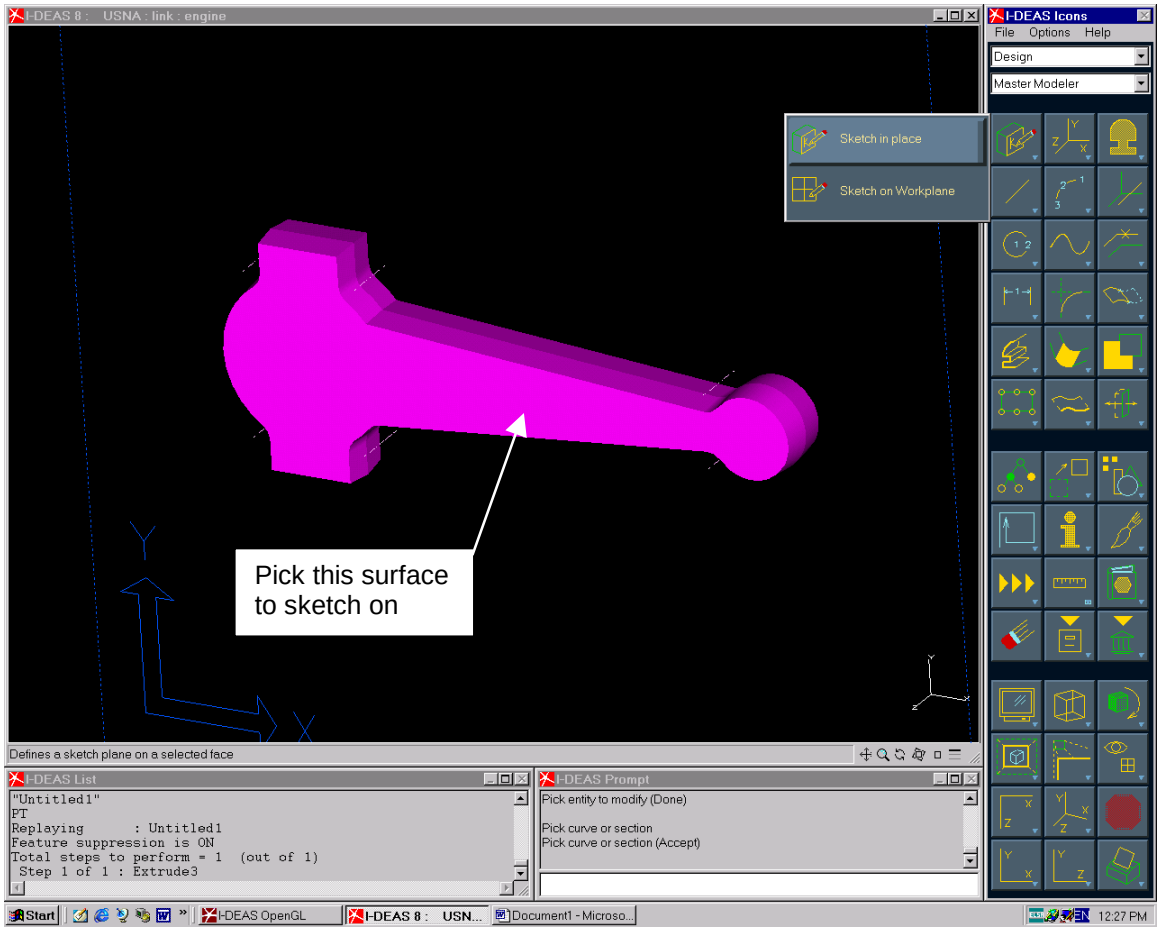


Figure 11

17. Sketch circles centered at each end of the connecting rod as shown. Modify the dimensions to be 1.0 in. dia. at the crank end and 0.5 in. dia at the small end.

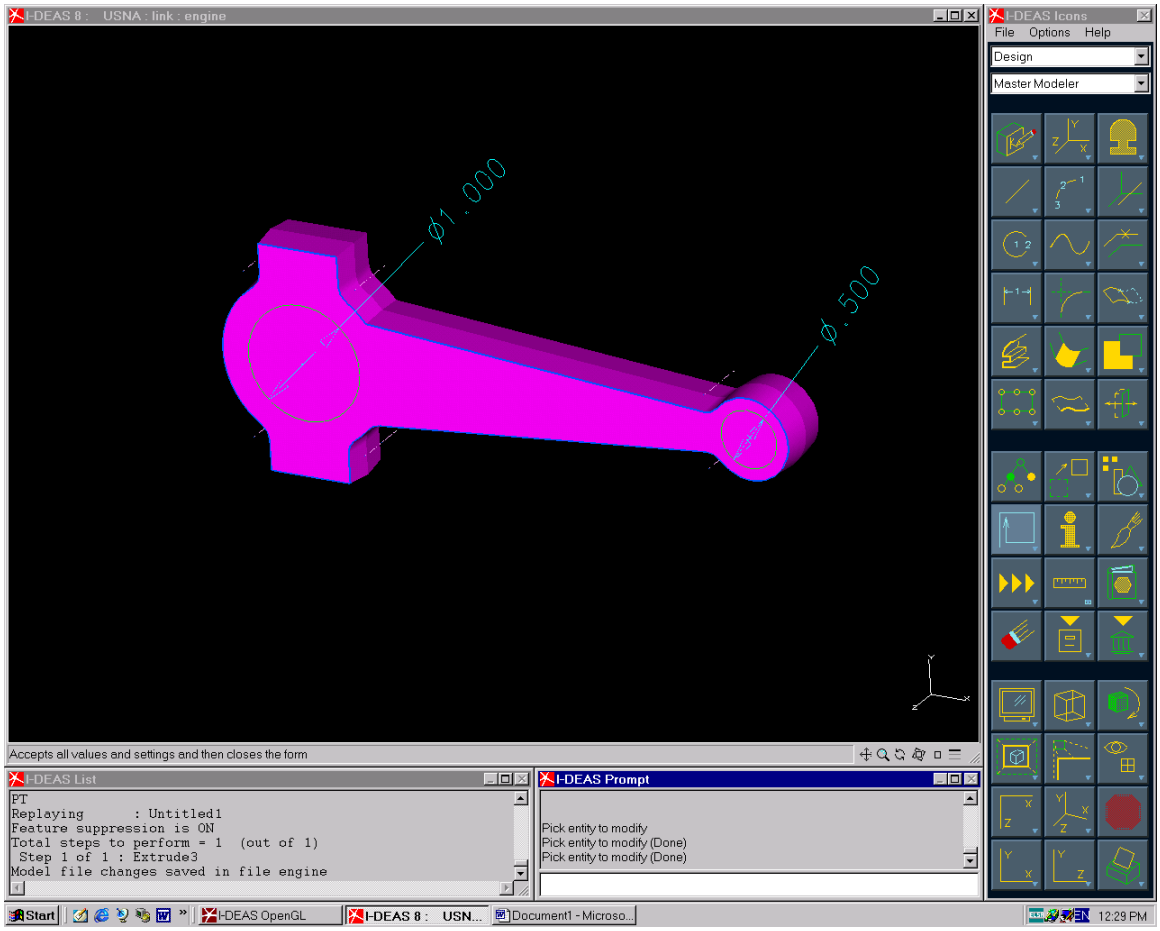


Figure 12

18. Extrude these circles thru the connecting rod. Make sure you select the **Cutout** option on the extrude form and select **Thru All** as the distance.

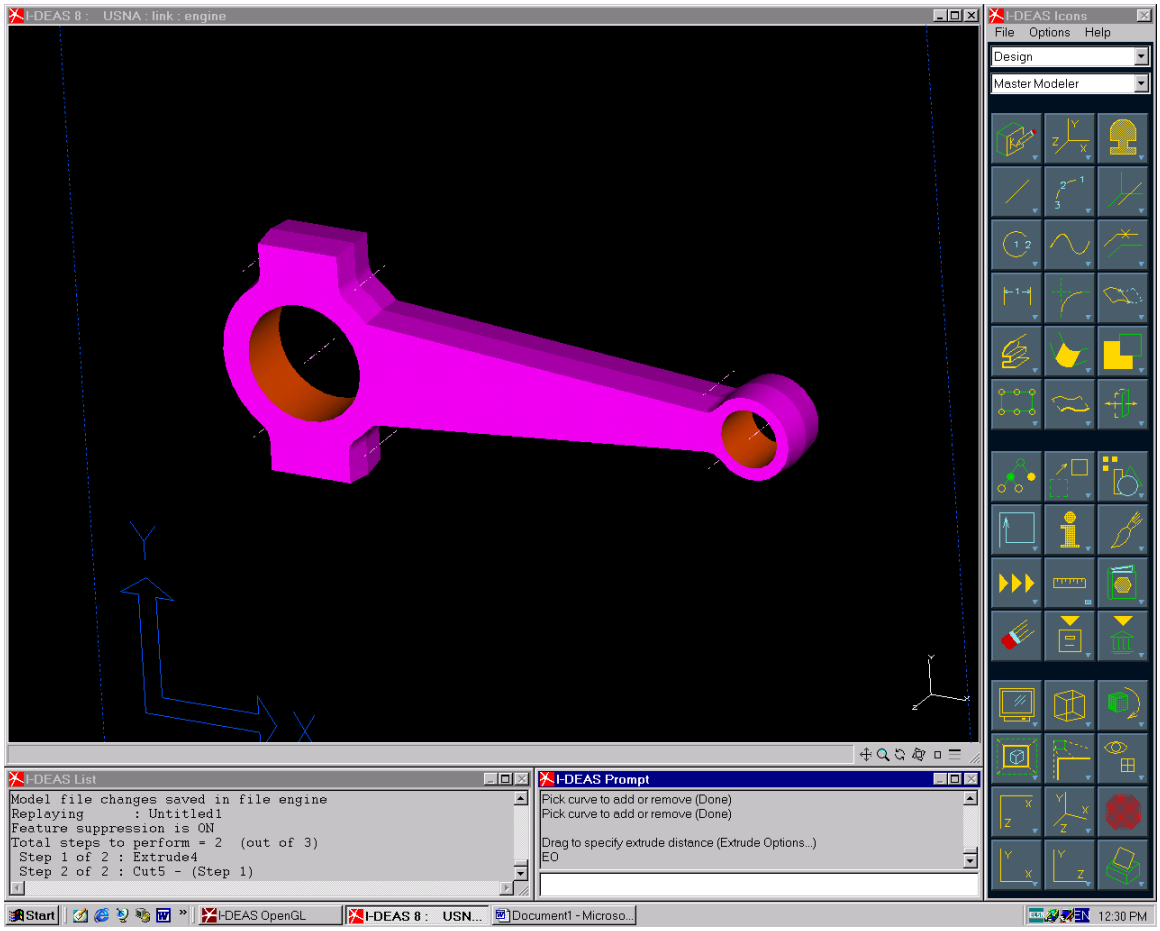


Figure 13

19. Pick **Sketch in Place**, and RMB and select **Create Ref Plane**.

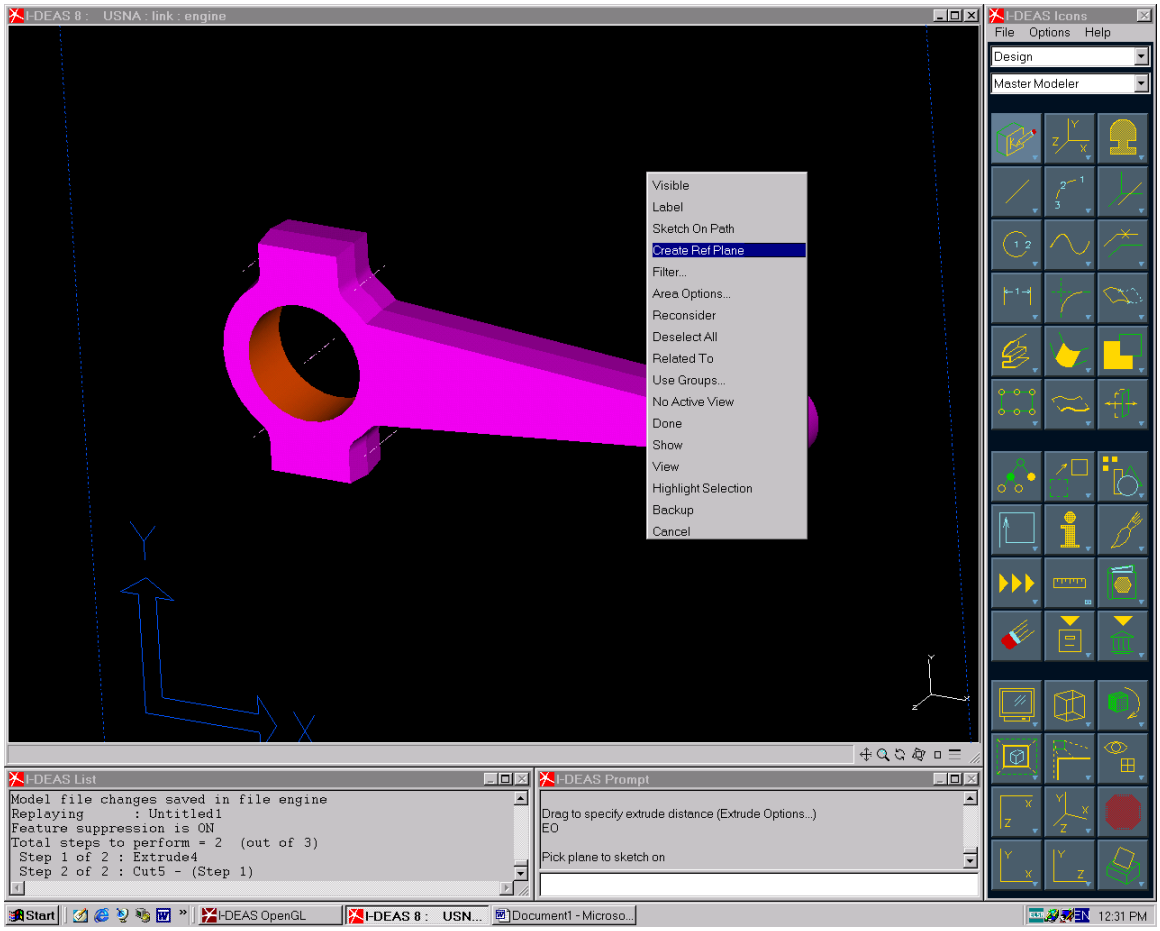


Figure 14

20. RMB again and select **Axis Planes** and then select Y**Z Plane**

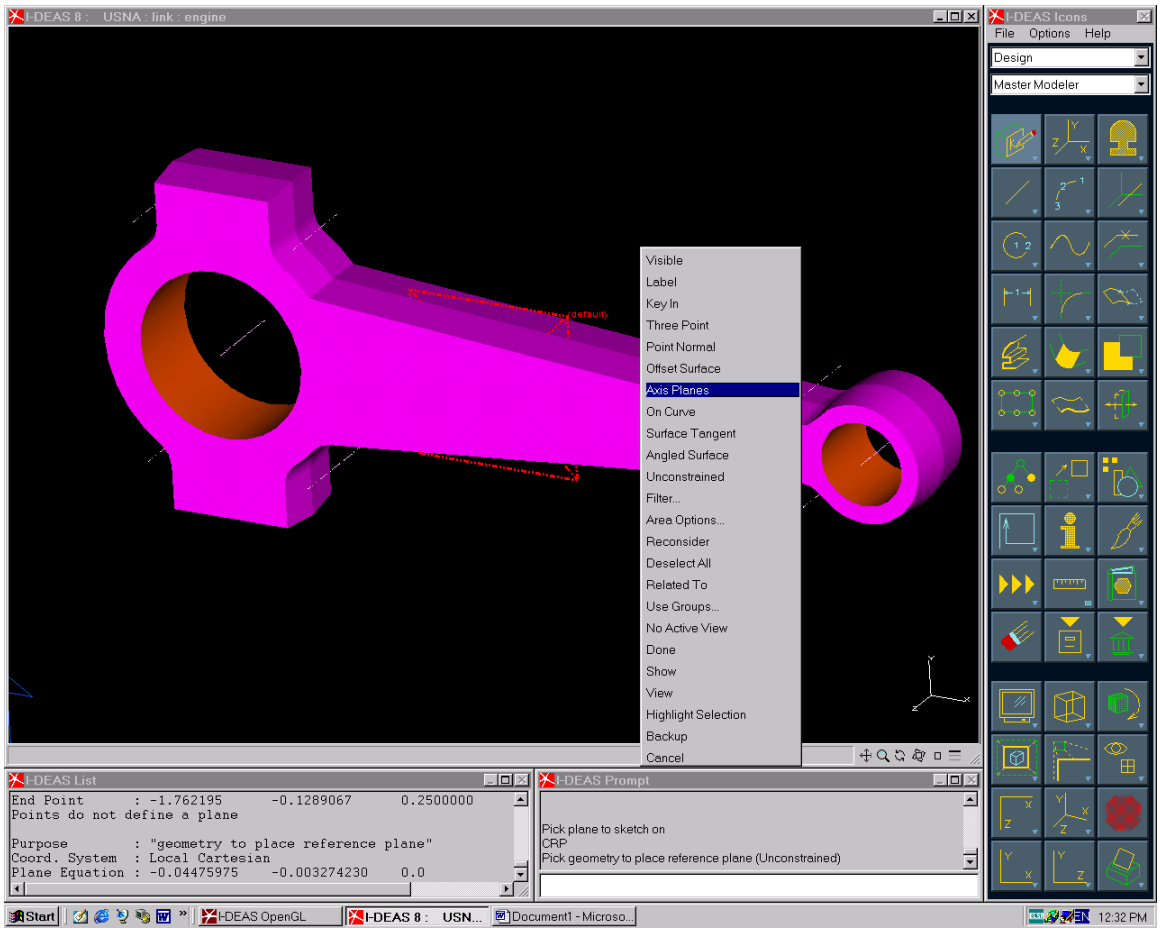


Figure 15

20. The Prompt Region will ask you to select a point for the plane to pass thru. Pick the center of the large hole on the left end of the connecting rod. A dashed blue outline should appear, showing the new reference plane that you can now sketch on.

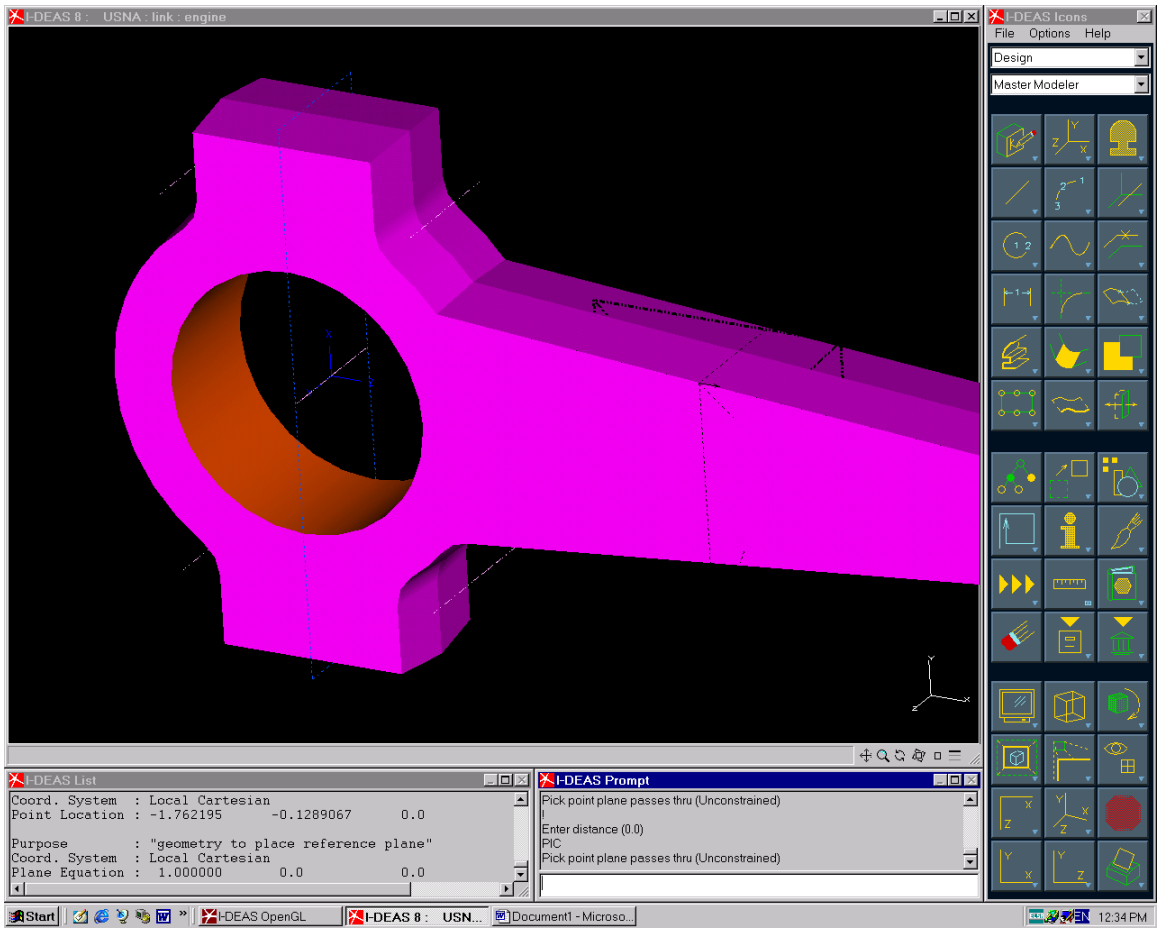


Figure 16

21. Switch to a *Line* display and view the model from the YZ direction. Sketch two circles as shown and modify the diameters to be 0.156 (5/32”)

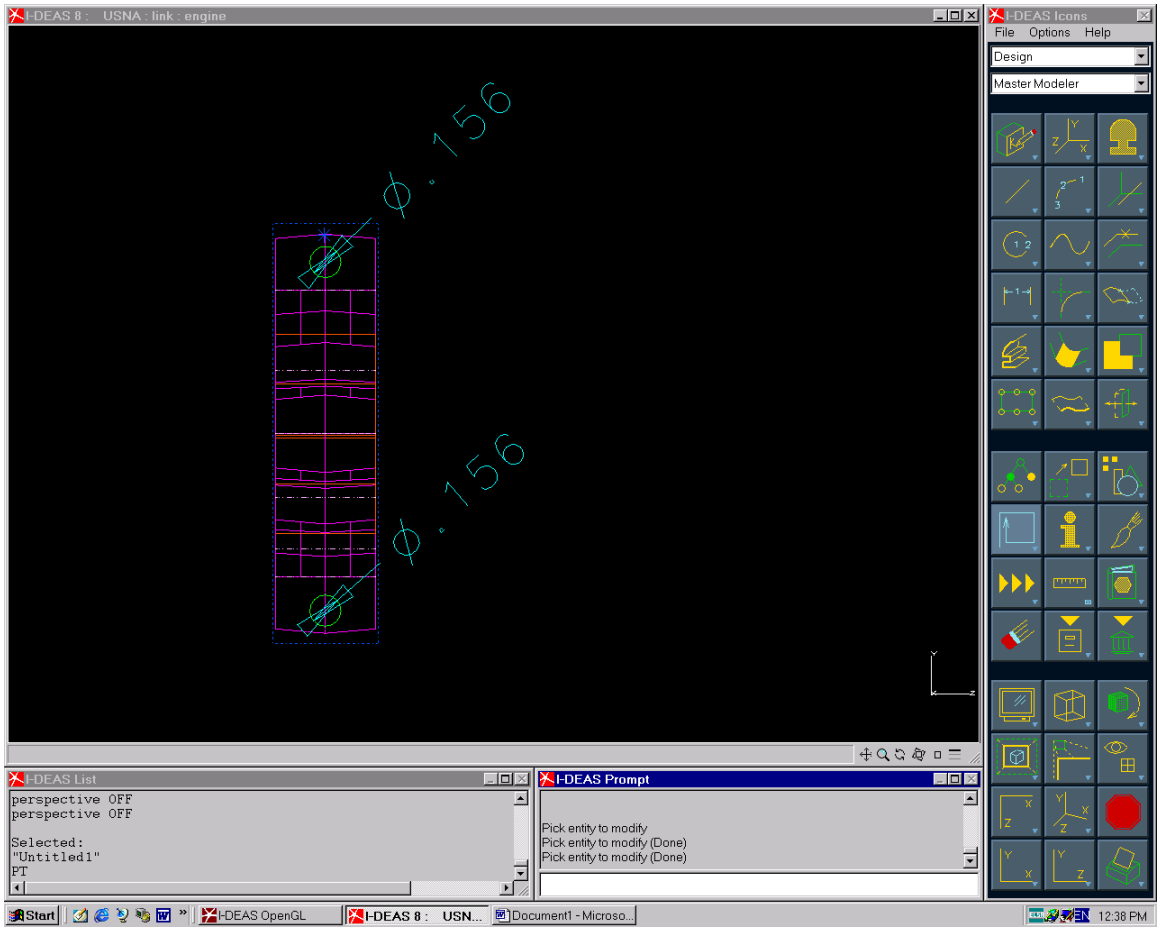


Figure 17

22. Add dimensions to locate the centers of the circles relative to the centerline of the hole and adjust the spacing to 0.85 in. as shown. Use the Dynamic Viewing buttons (F1, F2 and F3) to adjust the display so that you can pick the desired points. You will have to **Focus** (use RMB) on the centerline in order to create the dimension

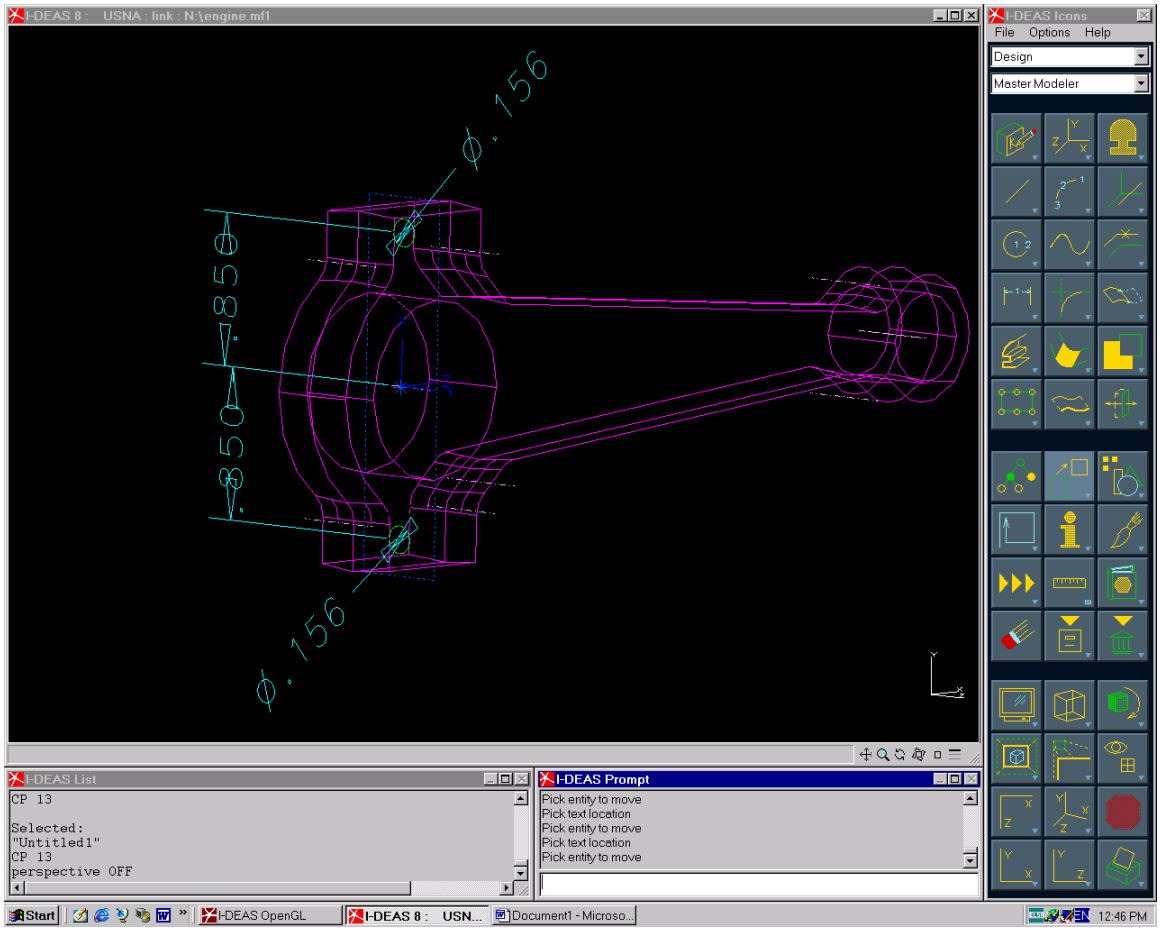


Figure 18

23. Extrude the circles to cut out holes as shown. Pick **Extrude**, select both circles, then **Done** (Center mouse button). Change the **Distance** drop down to **Thicken** and select a large depth, something greater than 2 inches, then **OK**

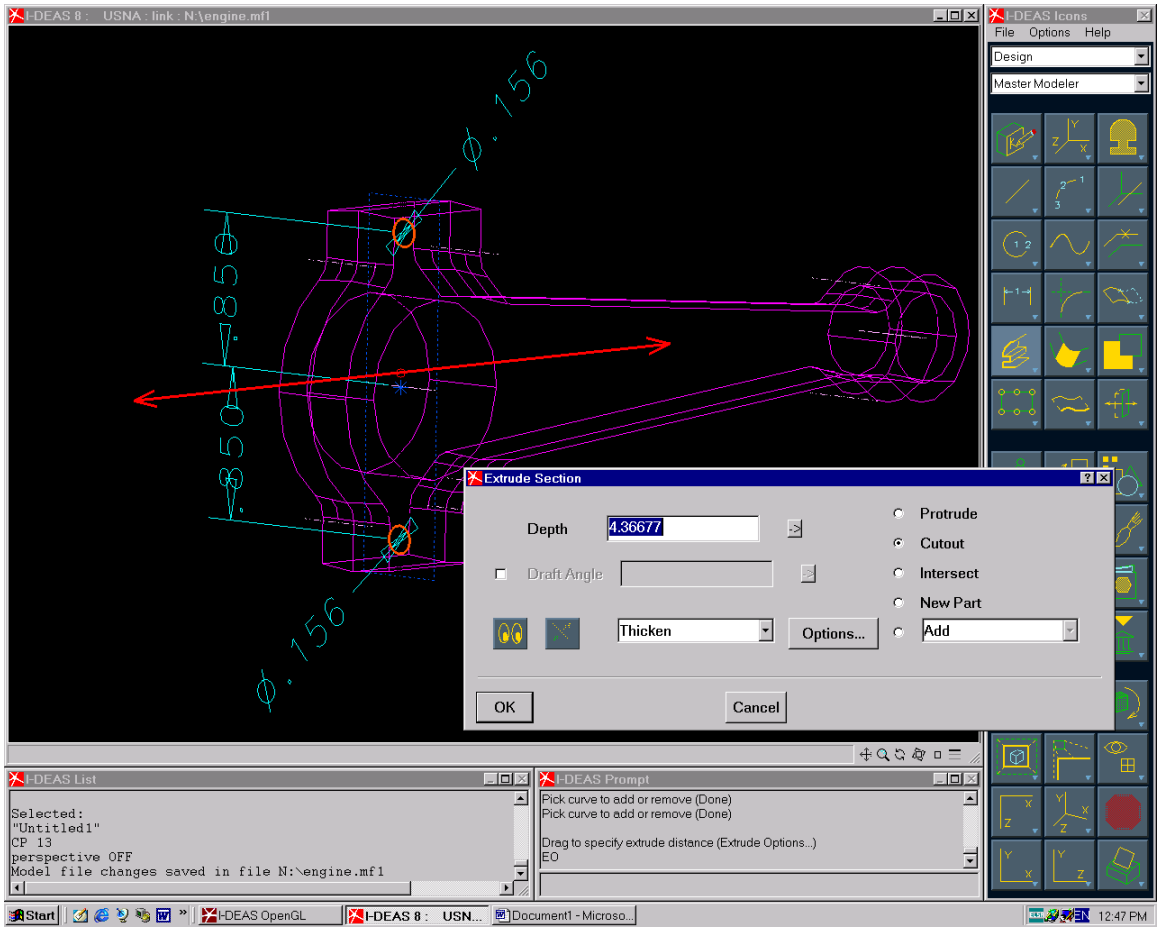


Figure 19

24. Separate the connecting rod into two pieces by selecting the **Plane Cut** icon. Select the connecting rod when it asks you which part to cut. Choose the option to *Keep both Sides* when prompted. Select the reference plane used to draw the small holes as the cutting plane

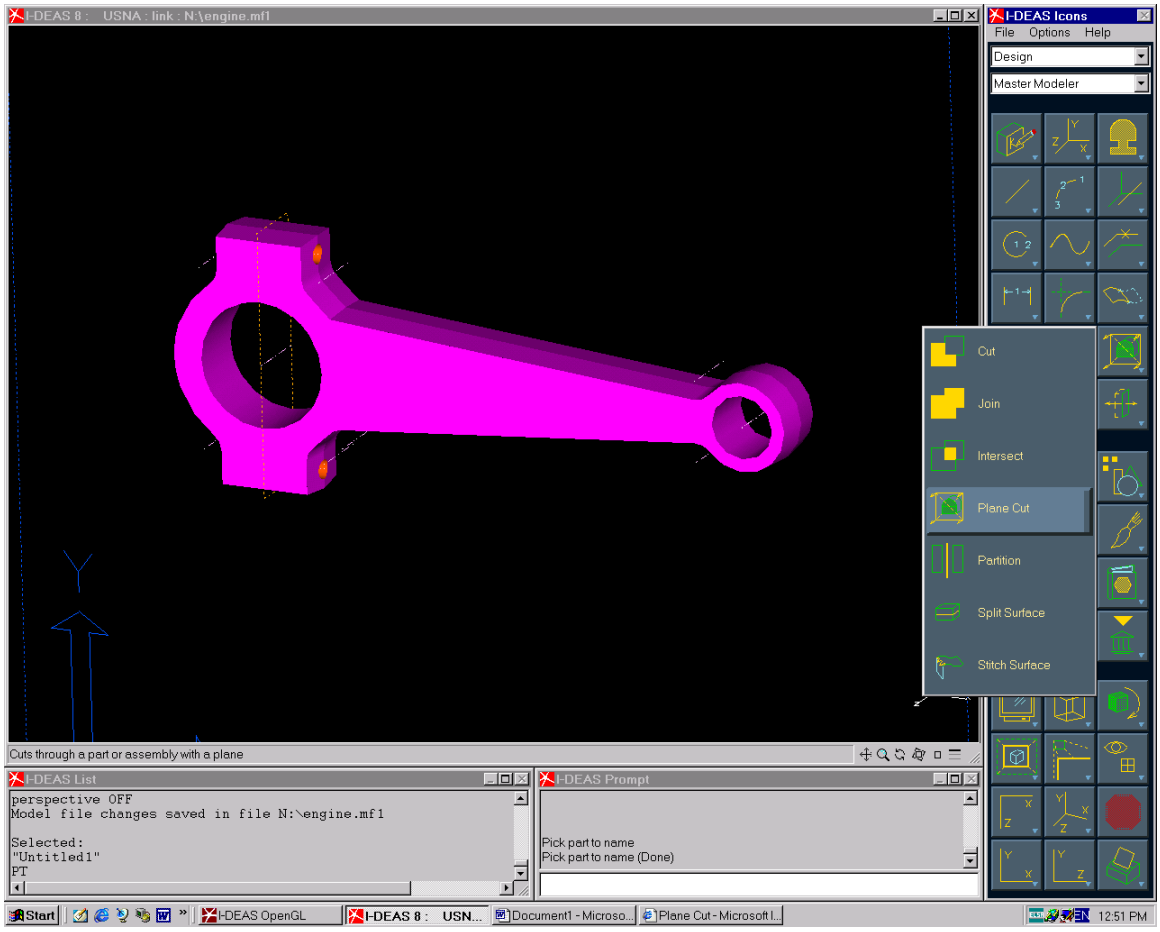


Figure 20

25. Let the positive side of the plane cut inherit the original part (just click the middle mouse button when prompted).

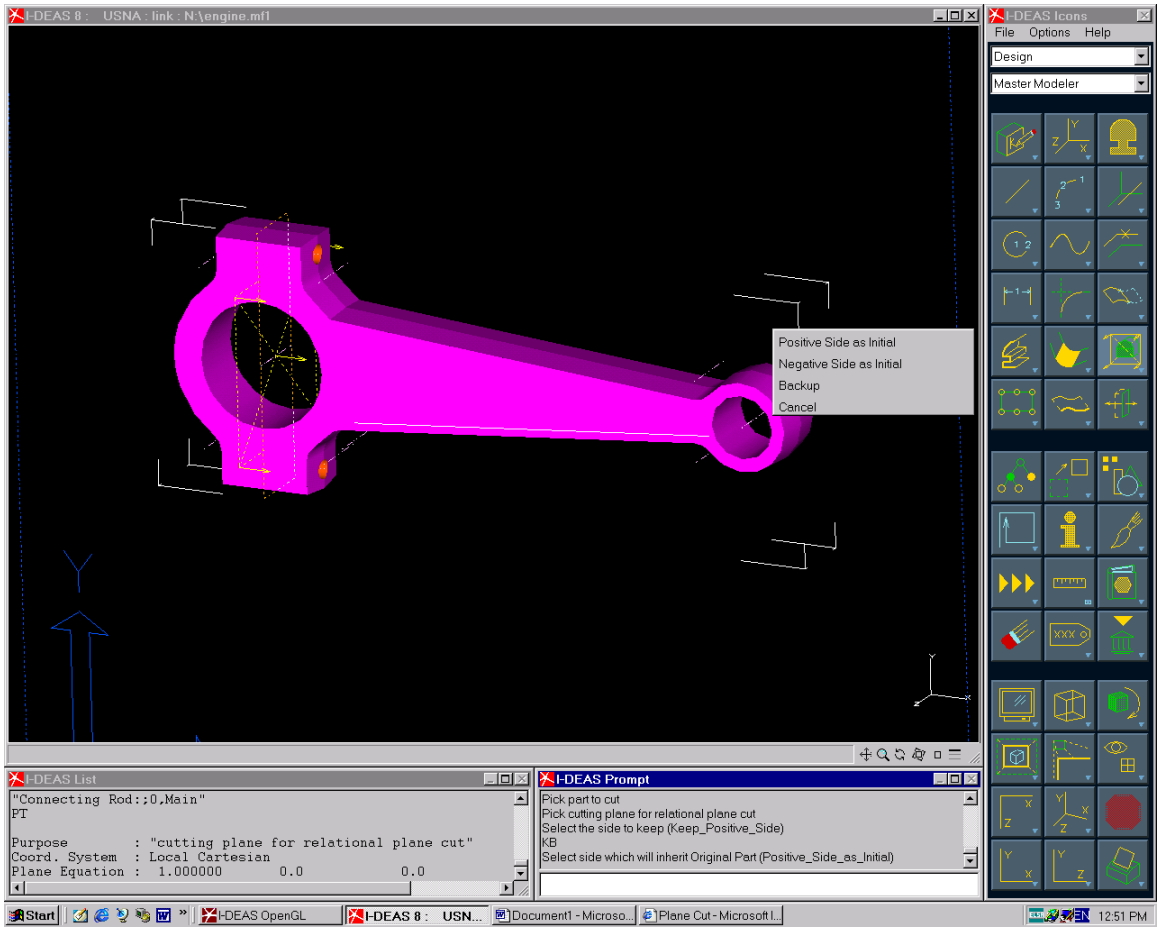


Figure 21

26. Put away the connecting rod into the bin. Put away the rod end as well. It will ask you to name the part when you put it away. Name the part *Rod End*.